Inquiry Lesson Plan

(Circle one)

Grade/Content Area	Grade 7: Equivalent Expressions
Lesson Title	*Estimating Profit*
State Standards: GLEs/GSEs **National Content Standards**:	**Use properties of operations to generate equivalent expressions.** **1**. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. **2**. Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05." **Solve real-life and mathematical problems using numerical and algebraic expressions and equations.** **4.** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. **A**. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width? **B**. Solve word problems leading to inequalities of the form px + q > r or px + q < r, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.
Context of the Lesson *Where does this lesson fit in the curriculum and instructional context? Is it the opening of a unit or a series of lessons?*	My students will evaluate expressions by applying the rules of order of operations, write statements that communicate reasoning for solving the problem, recognize applications of the distributive and commutative properties within these expressions, recognize, interpret, reason about, and use equivalent expressions, and finally apply the properties for mathematically manipulating expressions to solve linear equations.

Kees de Groot 10/21/12 11:57 AM

Comment [1]: I don't think this applies to your lesson. You are looking a problems with (equivalent) linear expressions and equations. Even though the example here uses profit, it deals with inequalities and not equalities.

	This one lesson is the opening to a series of lessons about solving equations, analyzing solutions, solving systems graphically and algebraically, and problem solving connections.
Opportunities to Learn *Differentiation: Materials, Learners and Environments*	**Plans to differentiate instruction:** This lesson is cooperative for the students to be able to learn form each other. They will need to refer back to what they already know about having an expression and be able to relate it to this real life situation. It will be differentiated for students with IEP's and accelerated students. The students who are more accelerated will be given a few more extended problems that will help them get ready thinking about the next lesson. **Accommodations and modifications:** All of the students will be able to participate in my beginning activity. The IEP Student's will work separately with the special ed teacher or myself (if necessary) so they can have the Inquiry lesson broken down for them to better understand. I will also allow them to use a calculator when simplifying equations. **Environment factors:** I am going to try to assume that the student's behavior will be under control considering this is a different kind of task they will be assigned. We will have an experiential environment ready for the students by allowing them to explore this new real life topic of profit. I want them to feel comfortable and ready for all kinds of questions considering profit may be a concept some students have never worked with before. **Materials:** • Textbook (for reference) • Pencil • Paper • Calculator (IEP students only: if necessary)
Objectives	The students will use the distributive and commutative properties to show equivalence, use contextual cues to interpret symbolic expressions, and solve a variety of problems using the commutative and distributive properties while working together in small groups in order to learn from one another. The students will be able to recognize they can use an expression or an equation in order to solve the given word problem/real world situation.

Kees de Groot 10/21/12 11:58 AM
Comment [2]: Curious how that might help.

	As a result of this lesson, students should be able to comprehend all of the properties to solve and simplify equations and expressions respectively; and be able to apply it to other types of questioning.
Instructional Procedures	**LAUNCH:** In the beginning of class I will write the definition of the terms "expression", "equation", "like-terms", "distribute", "commutative" on the board along with an example of what each of them are. I will have one practice problem below each. "Good morning class! I would like to begin today by reviewing words from our word wall. Can anyone tell me what an expression is?" The students will either not know or try to explain it as best as possible. I will give them examples of some expressions along with the definition, which I will be sure they all write into their notes. "Can someone please tell me what an "equation" is?" They again will try to explain what it is and I will show them how you can make an expression an equation. "Does anyone remember learning what these two things are?" Some may not raise their hands. "We will be working with them for the next few weeks. Here are some other terms we can use to help us solve or simplify our expressions and equations. Does anyone remember what we do when we have "like-terms"? I will allow them to recall the terms by example. "So are 3x and 7x like terms?" Someone who says yes, I will ask them why or why not, how do they know? "What if I had $7x^2$ and 7x…?" Why or why not? "Who remembers using the distributive law? If I have 10(3x+4), what can I simplify this to?" Hopefully one student will know how. Then I will go slow for the rest of the class. "Yes! The outside term is given to each term inside the parentheses. Now, what if I have –(4+5x). How can I simplify this?" I would like a student to make the mistake of not changing the 5 to a negative so that way I can better explain distributing the negative. "For those of you who need a refresher, look at the negative sign outside the parentheses as a -1. Then multiply everything inside the parentheses by -1. So we have -1*4 + -1*5x= - 4 - 5x" "Finally, lets be sure we understand the commutative law. Can someone tell me if I have 2*4, is that the same as having 4*2?" YES! "Multiplication IS commutative so no matter the order of what you are multiplying, it will always come out to the same answer.""

Kees de Groot 10/21/12 12:00 PM
Comment [3]: concepts

Kees de Groot 10/21/12 12:02 PM
Comment [4]: We don't say simplify anymore, because 30x + 40 is not necessarily simpler. So we ask (as your worksheet does) if there is an equivalent expression. This means that there is another expression that would calculate the same out put for a given input as the original expression.

Kees de Groot 10/21/12 12:03 PM
Comment [5]: The factor (not outside term) is multiplied with each term inside parentheses. Model proper math language.

Kees de Groot 10/21/12 12:06 PM
Comment [6]: Or you can explain the negative as meaning the opposite of 4+5x is the sum of the opposite of each term (in this case): -4 + -5x, which is equivalent to -4 – 5x.

Kees de Groot 10/21/12 12:07 PM
Comment [7]: This works too. Okay.

Kees de Groot 10/21/12 12:07 PM
Comment [8]: Be equivalent. Model proper math language.

	"Today I will be handing out a fun activity that has to do with finding a profit. First off what is profit? How do you think we can find the profit received? Just think about this question when you are working on the activity. I expect you all to get in groups of 2 or 3 and be able to ask each other questions only about the task that has been assigned. I also expect that you all show your work for how you came up with your answers." I'll allow my students up out of their seats and into random groups of 2 or 3. I'll lead the task by reading the expenses and income of the school sponsored 5k to raise money for a class trip to six flags. **EXPLORE:** I will circulate through the groups to be sure everyone is staying on task. "Don't forget to show your work. How did you come up with the total expenses? Total income?" or "What does this expression represent. Tell me, what does each number stand for?" If one student seems like they aren't following as well as the other students, I will tell the other members to explain to them how they got the answer. I will then have the student try to explain it back so I know they are grasping the concept. Then I will have them try to solve the next question with little help from their group members. To break down this concept, I will simply ask troubled students to take each value that we know and try to make an expression that helps us find what we are looking for. **SUMMARIZE/SHARE :** "Ok so what would like to share with me what they got for #1?" Whether or not they get it correct, we will go through what the student did and try to get the other students to figure out if there was a mistake or not. I will do this for every question. "Did anything about finding profit surprise you guys? Did you have any idea that you could implement distributive, commutative, like-terms, and expressions into real life situations?"

Kees de Groot 10/21/12 12:08 PM
Comment [9]: What should students be prepared for to discuss and show during the summarize phase as a result of their work in the explore phase?

Kees de Groot 10/21/12 12:14 PM
Comment [10]: This whole section is really sooooo much better. I like how meticulously you review prior knowledge. That is so crucial. Don't water down your instructional math language. Keep it mathematical and correct. Okay?!

Kees de Groot 10/21/12 12:15 PM
Comment [11]: Beautiful. Any questions that deal with equivalence? I suggest to include these, because it seems to take a prominent place in your worksheet. You may need to add the word equivalent to the Launch discussion.

	"Is there anything that you feel as though you are still stuck on when it comes to evaluating expressions?"
Assessment	**Launch:** In the beginning of class I will asses the students prior knowledge of evaluating expressions. Every step that is included in trying to find a solution to an equation (combining like-terms, distributing numbers) they will know prior to accomplishing this task. If the students are clearly not grasping the concepts we go over at the beginning of class, I will go over more examples until they understand enough to move onto our activity. **Explore:** I will be assessing the students by the answers they find during the activity. When I walk around I will be able to see what students are on the right track and which ones aren't. By assigning the follow up questions, the students will be given an expression instead of having to make their own, which will be less complicated. I will be collecting the follow up questions as an "Exit Activity" to see how well the students understood the material. **Summarize:** If the student's answers are correct as we are reviewing the answers to the task, I know that we will have achieved our objective to recognize equations given real world situations. My assessment at the end of class will more directly find out if the students are able to compute the simplifications of our expressions, as stated in the beginning of the objectives.
Reflections *This section to be completed only if lesson plan is implemented.*	**Student Work Sample 1 – Approaching Proficiency:** **Student Work Sample 2 – Proficient:** **Student Work Sample 3 – Exceeds Proficiency:** **Lesson Implementation:**

THE LESSON:

At their planning meeting, the organizers of the 5k discussed expenses an income. The following estimates were made:

- Expense for posters and newspaper, radio, and TV adds: $500
- Expense for souvenir T-shirts for participants: $6/child, $8.50/adult
- Income from business sponsors whose logos will appear on T-shirts and signs: $1000
- Expense for paramedics and an ambulance in case of emergency: $250
- Income from registration fees: $5/child, $15/adult

1. Estimate the total income, the total expenses, and the total profit if 40 children and 30 adults participate in the 5k.

(Hint: The difference between the total income and the total expenses is the profit)

2. Write two equivalent expressions for the total income in terms of the number of adults, "A", and the number of children, "C", that participate.
3. Write two equivalent expressions for the total expenses in terms of the number of adults, "A", and the number of children, "C", that participate.
4. Use parentheses and your results from 2 and 3 to write an expression showing the profit as total income minus total expenses. Don't simplify.
5. Write and expression for profit that is equivalent to your expression in part 4 but that is as short as possible (aka NOW simplify). Use the commutative and distributive properties to show that your expressions are equivalent.
6. Evaluate your profit expressions from parts 4 and 5 for A = 100 and C = 75. Can you conclude from your results that expressions are equivalent? Explain.
7. Compare the profit expressions you wrote in parts 4 and 5. What are the advantages and disadvantages of writing the profit expression in a shorter form?

Kees de Groot 10/21/12 12:17 PM
Comment [12]: Do not write as another equivalent expression.

Kees de Groot 10/21/12 12:18 PM
Comment [13]: See my comments above. You can't say that shorter is simpler. It is subjective and does not help mathematically. See my comments above.

Kees de Groot 10/21/12 12:19 PM
Comment [14]: YES!

Kees de Groot 10/21/12 12:20 PM
Comment [15]: In an equivalent form. Get away from shorter. It is an unproductive focus.

I will then go over the answers to these questions and then assign follow-up questions.

Answers:
1. Income will be 1000+5(40)+15(30) = $1650.
   Expenses will be 500+250+6(40)+8.5(30) = $1245.
   The profit is $1650-$1245 = $405.

2. 1000 + 5C + 15A or 1000 + 5(C + 3A)

3. 500 + 250 + 6C + 805A or 750 + 6C + 8.5A

4. (1000 + 5C + 15A) - (750 + 66C + 805A)

5. 250 - C + 6.5A

6. Any statement that shows equivalent expressions.

7. The short form is easier to evaluate, but the numbers 250, -1 and 6.50 do not reveal information about the specific sources of income and expenses.

Review:

In the Investigation you may have written:

(1000 + 5C +15A) – (500 + 8.5A + 250)

The first pair of parentheses in the expression can be deleted, but to remove the second pair, you must *distribute* the minus sign to each term within the parentheses.

1000 + 5C + 15A – 500 – 6C - 8.5A - 250

Remember*: Distributing the minus sign is the same as distributing -1!*

From here, we must remember to combine like terms!

250 – 1C + 6.5A

Don't forget how to use these steps! Now I want to see you take what you have learned and put it towards solving other expressions!

Follow up Questions:

You get a math test consisted of 10 questions, each worth 5 points. You answered two questions incorrectly. Show at least two ways to calculate his score.

Describe a situation that can be represented by the expression 100 - (x + y). Explain what x and y represent in this situation. Be Creative!

Use the distributive property to help you write an expression that is equivalent to 100 - (x + y) + 4x

C. Simplify the following equations. Check that the original expression and your simplified expression are equivalent by testing several values of x in both expressions.

1) (9x + 15) - (8 + 2x)

2) (7x - 12) - (9x + 15)

3) (14n + 9m + 15) + (23 – 9n – 3m)

4) 19 - 12x + 20 + 9x

Whatever is not finished in class, please finish for homework!

Extended Questions
(for students "ahead of the game")

Solve for x in each expression. Try your best!

1. 2(9x + 15) – (8 + 2x) = x + 3

2. (19 - 12x) - (-9x - 20) = x -1

3. 4 - 2(3x + 5) – 4 = - (-10 - 12x)